The American Biology Teacher

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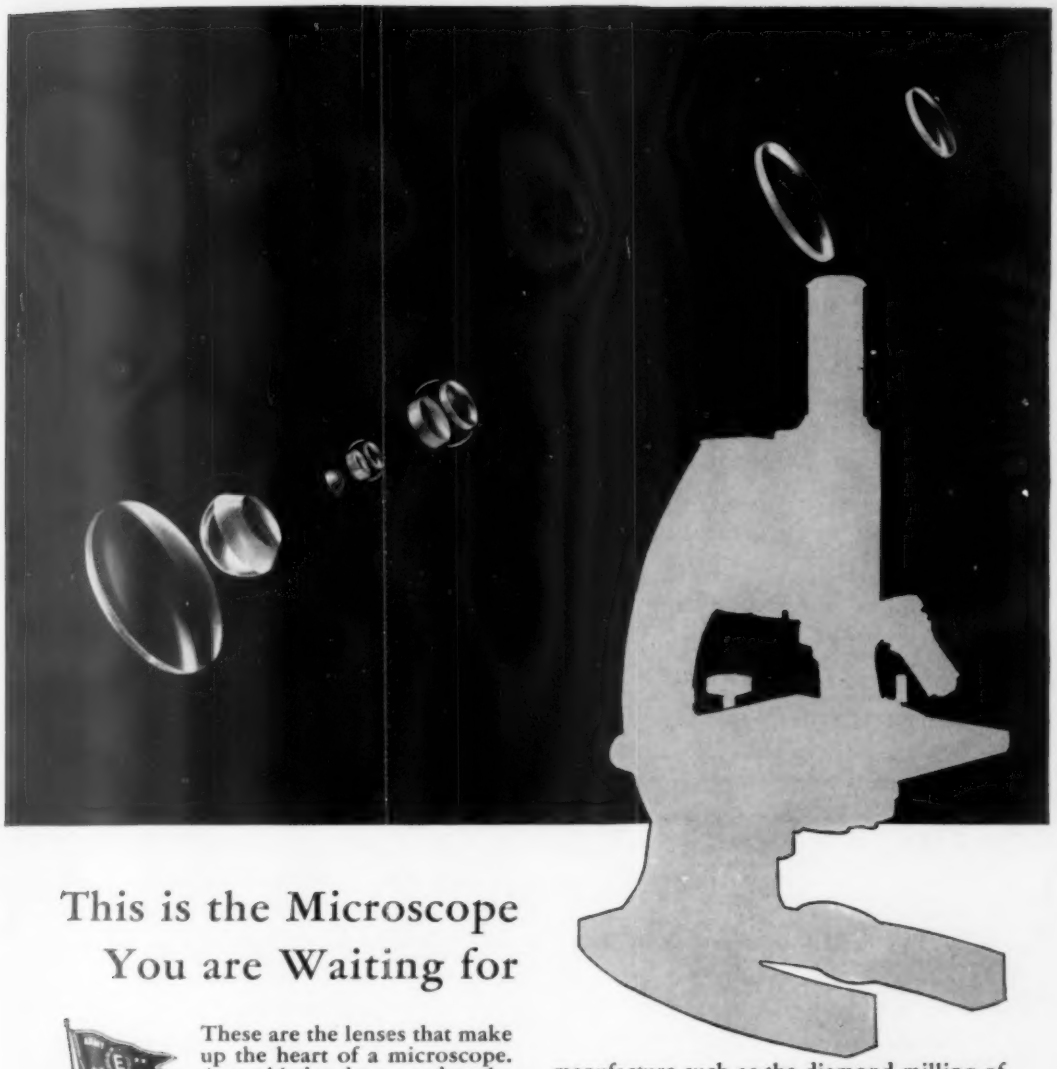

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The American Biology Teacher

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Photography

DONALD S. LACROIX
Amherst High School, Amherst, Mass.

Natural history photography is one of the most interesting branches of this already widespread hobby of taking pictures. Girls and boys who belong to the school Camera Club or who are interested in taking pictures should be encouraged to adapt their hobby to biology. This topic can be discussed under two headings—field photography and photomicrography.

Field photography: In this category there is an untold wealth of material in the back yard, park, on the hike, at summer camp, and during week-end trips afield. A lifetime's work can be outlined for the person really interested in natural history photography. All sorts of plants and animals and their habits can be recorded on film. The outstanding prerequisite is patience. Lacking this, a person equipped with the best cameras, exposure meters, and filters can bring back only mediocre results.

For field work the student needs a camera with which he is able to get within inches of his subject. The camera should be of the plate and film-pack variety with a double extension bellows, and it should be used on a tripod at all times. A plain background is often desired, and this can be obtained by using brown wrapping paper or a large gray blotter. Sometimes the black focusing cloth can be pressed into service.

For color work the student will find little better than an A2F Argus—using this camera on a tripod also, and stopping down the iris diaphragm for better depth and definition. This camera will focus on objects at 15 inches without supplementary lenses. Thirty-five millimeter Kodachromes of flowers taken with this outfit can be mounted between 2×2 glass slides and will project beautifully in the classroom. A tape measure is a necessity when setting up the small camera for close work, and a tilting top will enable one to swing the camera through many angles. The writer and his students are building up a collection of wild-flower pictures using the camera described above.

Photomicrography: The simplest setup for taking photomicrographs is shown in Figure 1. Here a small camera is fastened directly to the tube of the

FIG. 1. Showing set-up for taking photomicrographs using adapter for Argus camera on Spencer microscope.

microscope with a special adapter made especially to fit the camera lens to the microscope. This combination can be used to make pictures of stained materials from which 4×5 or 5×7 enlargements can be produced. These can be pasted in the pupil's notebook and parts of the picture correctly labeled. Or they can be bound under glass, making a permanent mount for classroom use.

Larger cameras can be used with microscopes if a horizontal set-up is arranged. A homemade adapter for making a light-tight connection between microscope and camera can be evolved from various sizes of mailing tubes.

The source of light for photomicrography may be a lantern slide projector or a 100-watt electric light bulb in the student-made microscope light shown in Figure 2.

Trial exposures must be made to determine the correct time. Carefully compiled notes on the nature of the light source, its distance from the camera, the type of objective used, the nature of the slide photographed, and kind of film, will help the student succeed in producing excellent pictures.

DOS AND DONT'S

1. In shooting flowers, wait until the wind dies down, or use a cellophane tent. Never "steady" a stalk or branch with the hand, because this will only introduce more motion rather than less.

2. Try to get pictures of plants in their natural habitat—bring them inside only for special purposes. Maneuver around so that the background is in shadow.

3. A mirror to reflect sunlight into a bird's nest will help make a better picture.

4. Use side-lighting to give third-dimensional effects—*i.e.*, have the line of sight from the camera to the subject and the line of light from the sun come together at a 40° angle on the subject. A

FIG. 2. Microscope illuminator made from two tin cans, by high school student. A 60- or 100-watt bulb suspended in larger can has its rays directed downward at an angle by the smaller can soldered over a hole cut in the larger one.

piece of white cardboard should be used to reflect light into the shadow side of the subject.

5. Stop down the iris diaphragm to about f.16 or f.22 for sharp detail and depth of field.

6. A panchromatic film (such as Panatomic, Panatomic X, Iospan, or Super Pan Supreme) gives best results for flowers and autumn coloring. Fast films are not necessary unless pictures of living animals call for fast shutter speeds.

7. In winter, keep camera under the clothing, and do not leave outside too long as shutter mechanism may contract and stick. Also look out for fogging of the lens from condensed moisture or breath.

8. An exposure meter of the photoelectric type will save much film by preventing over- or under-exposure.

9. When using double-extension on a camera for very close work, allow about double normal exposure.

10. In photographing insects, calm them down with a short sojourn in the refrigerator. They won't be so nervous after a brief cooling!

11. When photographing bird or animal tracks in snow, set the camera on a tripod at a height of about 18 inches to 2 feet above the snow surface. Focus on the second track or foot print and stop the iris-diaphragm down to f.22 or smaller. Under-expose slightly to save surface detail. Aim almost into the sun or quartering into it. Shield the lens. Use a yellow filter. Take this type of picture when the sun is low, either early in the morning or late in the afternoon. Orthochromatic film is best here.

12. It is advisable in some shots to include something which will indicate the size of the object photographed. This "something" may be a ruler, steel tape, a pencil, or even a person's hand or finger. One of the prettiest natural color shots of dandelion blossoms, taken at a distance of 15 inches, looms so large on the projection screen that some folks exclaim "What pretty chrysanthemums"—just because there's nothing to show relative size.

13. Vibration is the bug-a-boo in photomicrography. The opening and closing of a shutter serves to introduce more of the same. Avoid it by doing as follows: hold a piece of black paper between objective lens on microscope and the slide (or other material being photographed). Open shutter, withdraw black paper and count the number of seconds necessary to make the proper exposure, insert black paper again and close shutter. Remove paper. Advance film for next exposure (or if using plate camera, replace dark slide and remove plate holder).

Things to Shoot: Flat pictures or lantern slides for class-room projection can be made by pupils from negatives of:

1. Trees—shade trees, local forest trees, hard woods, evergreens, deciduous. Shoot them winter and summer to get general shape and appearance. Photograph close-up of trunk to show texture. Record twigs to show bud arrangement, leaves to show leaf type, flowers, fruits. Using Kodachrome, record the changes in autumn coloration on one maple tree. Repeat year after year and see if a tree goes through the same color changes every fall.

2. Flowers—best done in color. A collection of local wild flowers. A series on local garden species.

3. Weeds and poisonous plants—an excellent project.

4. Seed dispersal—many interesting adaptations in fruits for scattering their seeds can be recorded.

5. Habitat groups or plant associations—a collection of photos to show

desert, swamp, forest, sand-dune, marsh, sea-beach, and high altitude association calls for a lot of interesting work. An especially useful series can be photographed seasonally—a few pictures being taken during each of the four seasons.

6. Insects—there is a wealth of material here for the photographer in getting pictures of life stages, nature of injury to the host, peculiar adaptations, control methods for pests, activities in a bee-hive and so on.

7. Birds—nests, eggs and young are comparatively easy to get. Adult birds can be photographed if the student has a lot of time and more ingenuity and still more patience.

8. Wild animals—this branch of work calls for a great deal of time out-of-doors, quick thinking and acting, a knowledge of the animal's habits and the ability to live out-of-doors. Flashlight set-ups may be baited and operated in the manner of trapping the animals. Also visit the local zoo.

9. Farm animals—types and breeds of domesticated animals provide a most interesting project.

10. Pets—don't forget these, and they are right around home.

11. Fungi — mushrooms, toad-stools and bracket-fungi offer a rich field for the photographer.

12. Fish—a collection of local game fishes in natural color makes a challenging project for any youngster. It might be well to "tie-up" with some experienced fisherman.

13. Freaks—the unusual in nature make a fascinating photo hobby. Trees or plants growing in peculiar places, such as pines on boulders, twisted trunks, branches growing in odd shapes and roots growing through other plant parts make interesting pictures. Monstrosities such as double-headed turtles and animals with extra legs should be recorded on film.

14. Photomicrographs of plant and animal tissues studied in the laboratory are always instructive and fun to take. Try Kodachrome on stained slides.

15. Tracks of animals in snow or sand can be photographed early in the morning or late in the afternoon when the sun is low enough to render good shadow pattern. It is best to catch these trails soon after they have been made. This study often leads to some interesting detective work as in the case of a fox track on snow following that of a mouse; or the wing marks of an owl at the end of a rabbit trail. Set up the camera so that it will shoot into the sun or quartering into it. Shield the lens so that the sun's rays do not strike it. This method allows for deep shadows in the footprints, and makes them stand out more distinctly against snow or sand.

16. Industries—any industry involving biological processes will present a large number of interesting possibilities. Commercial fisheries, lobstering, shell-fishing are a few sea-shore industries. Dairying, orcharding, forestry, gardening (victory type just now) all make use of many biological fundamentals. Baking, brewing, wineries, distilleries should show commercial uses of enzymes and ferments, and if the foreman or superintendent of one of these is approached, he could arrange for some picture taking.

It is a source of regret that it was not possible to obtain, for the photography issue, an article dealing with the use of amateur movies in biological science. Several teachers who were known to have some experience along this line were contacted. Three of these had joined the service or were about to be inducted; others were unable for various reasons to take the time to work up an article. If you have some experiences with the use of movies in the teaching of biology and if you want to share them with the readers of The American Biology Teacher, why not write them up and submit them to any member of the editorial staff?

Bird Photography with Biology Students

ALLEN DOWNS
Stevens College, Columbia, Missouri*

Two years ago one of my students in a biology class became interested in bird habits. He wanted to make observations, so together we rigged up the blind illustrated, and we used it in the spring to watch nesting. Other students grew interested and compiled their observations, making a fairly complete set of notes on the water ouzle, yellow-headed blackbird, and red-wing blackbird. Much interest was aroused in the class as a whole, and the obvious connection of photography was realized.

The following year, students in a photography class under my direction cooperated with biology students in using the blind. Our difficulties were the usual ones, no equipment and little money. Our advantages were primarily a cooperative school administration and a few unusual students.

Our blind was erected from a music stand and a large umbrella. We used about four yards of unbleached muslin, dyed green, and sewed to the cloth of the umbrella. Holes were cut for windows and ventilation. The total cost was about $4.00, the major expense being the music stand. A tripod or Victor light stand could be used as a base and would perhaps be more steady. We saw that the wind blowing the cloth frightened some of the more timid birds so we drove sticks into the ground along the bottom, pinning the edges of the muslin. A heavy wire ring sewed into the hem would be better if one did not mind sacrificing portability. On some occasions, when special conditions made use of the umbrella blind impractical, we took advantage of natural hiding places, but on the whole this simple blind served most satisfactorily. We used it in the trees, in water, and once on a step ladder (not so effectively).

Our photographic equipment improved as time went on, but we started with a used 5×7 Corona view camera, equipped with a nine-inch rectilinear lens and a few plate holders. This cost $12.00 and I believe it would not be impossible to find similarly priced equipment even today.

In order to produce a proportionately larger image and to save film, a $2\frac{1}{4} \times 3\frac{1}{4}$ reducing back was used. The back together with a film pack adapter cost $12.50. The result was a somewhat cumbersome $2\frac{1}{4} \times 3\frac{1}{4}$ camera with a lens of nine-inch focal length. Since ordinarily a $2\frac{1}{4} \times 3\frac{1}{4}$ camera has a lens of about four-inch focal length, considerable magnification was achieved with the nine-inch lens. A homemade wire view finder was attached with a parallax adjustment. A calibrated scale was scratched on the back framing piece, as illustrated. The scale was determined by framing the image in the ground glass at commonly used distances. This was useful when quick work was necessary. A fairly large lens shade was made from sheet metal with a friction fitting and lined with black vel-

* The work reported in this article was done while the author was teaching in Boulder High School, Boulder, Colorado.

vet. We found a large Crown tripod at a second hand store for $3.00. This equipment is adequate for fairly simple problems in bird photography and the total cost need not be over $35.00.

For more serious work to be used for visual education, I managed to assemble more elaborate equipment. I used a Leica with a 135-mm. f. 4.5 lens giving an image somewhat over twice normal size. This lens is coupled with a range finder making for speed and accuracy in focusing. Another advantage of this lens is that a simple ground glass unit may be used as the lens is attached to the tripod instead of the camera. The f. 4.5 lens is slow for some conditions but ordinarily it is satisfactory. Most of my pictures have been taken at f. 9 at 1/40 second in bright sunlight.

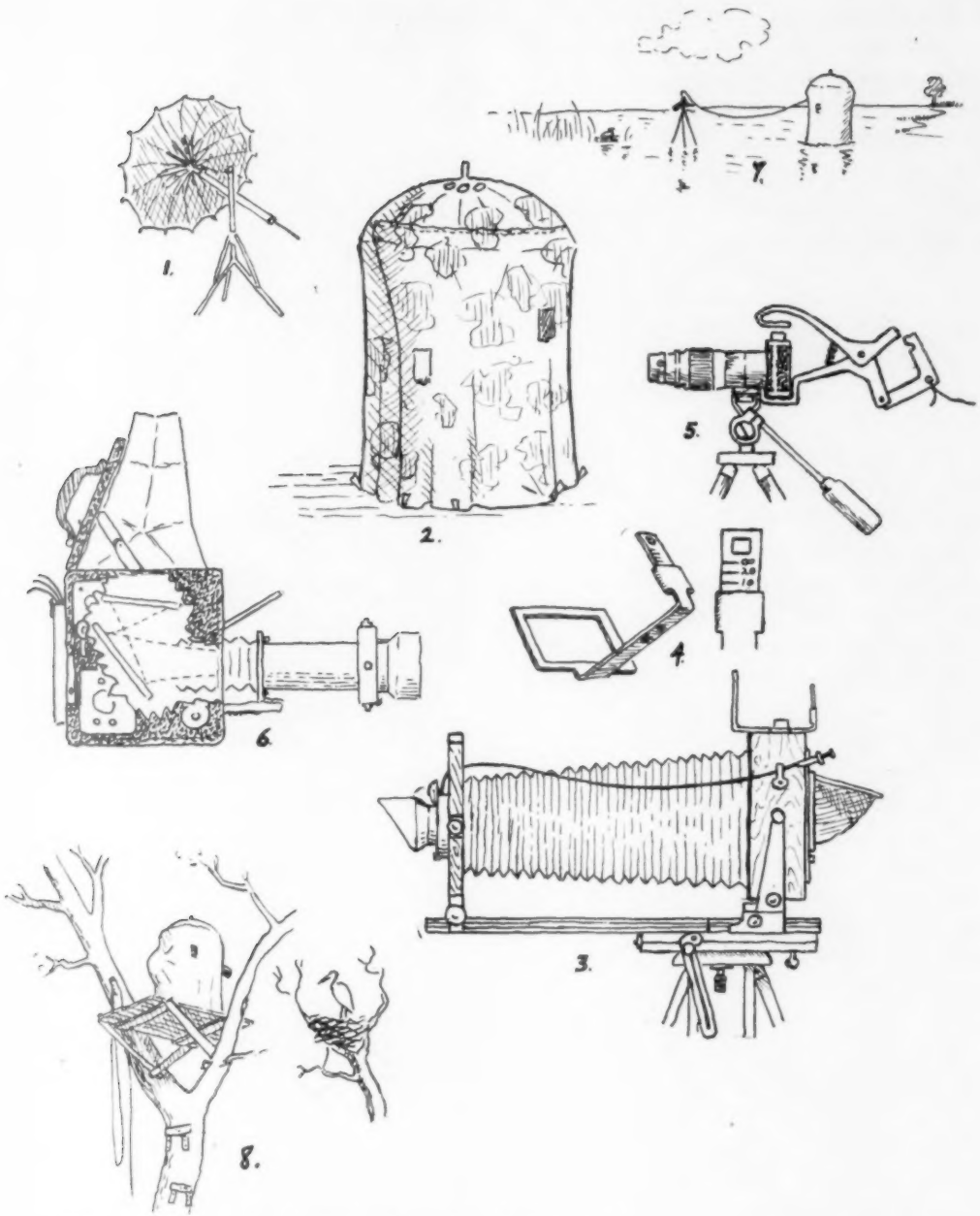
One of my students came upon a large colony of Great Blue Herons in 1942. There were 25 nests in use, all at least 50 feet from the ground in large cottonwoods. This heronry was about six miles east of Boulder, Colorado, in a grove which was cut on either side by creeks, and therefore very difficult to approach during the spring rains. The owner of the property had watched and protected the birds for several years and the site had evidently been in use long before this. I was anxious to get stills and movies in color of the adults feeding the young, so a student and I built a platform in one of the centrally located trees. After climbing the tree a few times with the aid of ropes, it became evident that some method less strenuous should be employed.

As the young birds were nearly ready to fly, and the problem was developing into a major operation, we decided to be leisurely about it and get it done correctly for use the next year. We made steps of 1×2 hard wood with shorter pieces nailed to the ends, forming an inverted "u." This made our trips up and down the tree much easier and considerably safer. The wooden platform was constructed on the ground and pulled up to a crotch in the crown of the tree about 12 feet from the top, resting on branches that I hoped would be strong enough. We had difficulty in bracing the platform properly and finally found it necessary to use large supports of wood as shown in the illustration.

The following spring I returned and as I had hoped, the platform had come through the winter intact. The birds were just beginning to repair the nests. I thought it advisable to wait a few weeks rather than risk frightening them away.

Late in May I started observation and photography of the birds in earnest. I pulled the cameras, tripod and blind up on a rope and arranged it, securing the blind by nails. The Leica, on tripod, was directed at a nest about 20 feet away in another tree. The young were still incubating, although a few had already hatched. In waiting for the adults to return, time weighed heavily on my hands and I was reduced to counting nails, catching flies and finally to utter boredom. After what seemed to me hours, (it was actually only about two), they began coming in. As was usually the case on succeeding trips, no bird settled on the nest at which I had the camera directed, so a shift was necessary. The day was clear and bright so the camera could be used at a small aperture and fairly fast exposure, and a few pictures were made after having spent about five hours.

After several visits the birds became used to the strange disturbance and the presence of the blind and returned almost immediately. It then became a very pleasant adventure and a number of my friends were induced to climb the



1. Umbrella and music stand, showing mode of attachment.

2. Umbrella blind, showing camera openings and ventilation holes. Note stakes around base, and camouflage.

3. View camera, showing view finder in place, homemade lens hood and cable release bracket, also reducing back.

4. Homemade view finder, showing parallax adjustment.

5. Leica camera with 135-millimeter lens, showing remote control attachment.

6. Graflex camera, showing path of light through the reflex equipment and extension tube for 6-inch lens.

7 and 8. Umbrella blind in use.

tree with me. Just before the young herons were ready to fly, the blind was an exciting place to be with the adults returning from all directions as fast as they could catch fish. The young birds fought among themselves over the food and it seemed impossible that they could keep their footing. Indeed, a few did not, as we found several dead ones at the foot of the trees and once came upon one that had just fallen. He was hurt, apparently, so we took him home with us and caused much excitement in our neighborhood. The next day we returned him to the heronry and put him in one of the more accessible nests evidently none the worse for his experience.

The movies proved to be a bit too much for me, as I had to choose between a six-inch telephoto lens and a normal one for a 16-mm. camera. The telephoto lens covered little more than the beak of a heron, and the small lens two or three nests at once. An 8-mm. camera would have been less expensive but the pictures would have been too small for visual education use.

Very often wilder species would not return as long as the blind was near the nest, I found that a remote control was necessary. With the camera mounted on a camouflaged tripod, and placed quite close to the nest, a string can be run back to the blind. I have used this method successfully with ducks and grebes by placing the blind 50 to 75 feet from the nest. The tripper was made from the metal protection for covering permanent electrical wiring.

I have found a Graflex equipped with an old rectilinear lens mounted in an extension tube useful in taking hand pictures of birds in the open, such as bird flight or birds that may be easily approached, such as ptarmigan or juncoes. This outfit is too cumbersome for use in the blind but the reflex focusing is ideal

Screech owl. Taken with Speed Graphic, with No. 0 flash bulb synchronized with shutter.

for moving objects in the open.

The Exacta camera, which is a reflex type on a smaller scale than the Graflex, is particularly good for bird work. Made in 35-mm. and vest pocket size, it is one of the very few true single lens reflex cameras in the 35-mm. size. The main advantage of the single lens reflex is the ease in focusing and finding the image. Also, any long focal length lens may be used with the proper fittings or extension tubes, whereas in the coupled rangefinder types, the lens fitting is quite involved.

In buying used equipment, a guarantee should be demanded for a period of time sufficient to thoroughly test the camera. Upon first examination, be sure that the frame and box are true, and that the lens mount is parallel to the film car-

rier. See that the focusing arrangement functions, or if not, that it can be easily repaired. In the case of a bellows camera, check with the back off near a bright light for pinholes in the bellows, and see that the bellows are pliable and not brittle. If there is a focal plane shutter, check for holes in the curtain and test for strength. Check the shutter at all speeds for approximate accuracy and naturally check for missing parts.

In testing a lens, make a diagram on paper using horizontal and vertical lines overlaid with concentric circles. Take a picture of this diagram, using the lens. If the diagram is reproduced accurately, lines straight, and same thickness and perfect circles, the lens is an excellently corrected one. To check definition, use the lens as a projector for a sharp Kodachrome slide. A covered light behind the Kodachrome, throwing light through the lens and onto a white card ten feet from the lens, should produce a sharp image.

Good equipment is, of course, a decided asset, but we found that good pictures could be taken with improvised equipment. Perhaps more education and enjoyment is derived if it does not come too easily.

Canadian Nature, a magazine founded in 1939 for the purpose of presenting interesting nature information in popular form, is issued in September, November, January, March, and May of each year. It is an official publication of the American Nature Study Society.

Included among the members of the advisory board are: Ellsworth Jaeger, Buffalo Museum of Science; Ernest Thompson Seton, Santa Fe, New Mexico; Dr. Frieda Cobb Blanchard, University of Michigan; Dr. E. Lawrence Palmer, New York State College of Agriculture; Dr. William G. Vinal, Massachusetts State College.

Information concerning *Canadian Nature*, may be obtained from Canadian Nature Magazine, 177 Jarvis Street, Toronto, Ontario.

Photography Through the Microscope

LT. THEODORE DOWNS
Medical Administration Corps, Army Air Forces

This article is a report of the procedure used in taking simple microphotographs through a standard laboratory microscope.

The equipment was as follows: a dark room, a microscope, a Model C, F 4.5, 35 mm. Argus camera, a supply of Super-X film, a reading lamp with a 60-watt bulb, a piece of thin ground glass, cut to fit the frame of the camera.

It was noted that too much light was a disadvantage, and that it was best to move the lamp to a distance suited to the density of the object to be photographed. In most instances the 60-watt bulb was placed about ten inches from the reflection mirror of the microscope. The procedure was relatively simple. The slide was placed under the desired objective and the focus adjusted as usual for microscopic observation. A small notch was filed on the back side of the fine adjustment of the microscope, then the camera was placed directly on the ten-power eye piece. The camera was set at its longest distance and with the diaphragm opened to its largest stop—in this case F 4.5. (There was no need for a support or adapter of any kind. Since we made the exposures in a dark-

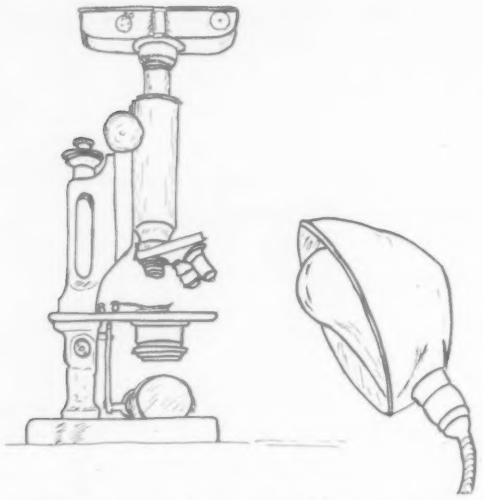


FIG. 1. Argus camera in place on top of laboratory microscope. 60-watt bulb at varying distances from the microscope.

ened room it was not necessary to have a light-proof connection between the microscope and camera.) The image was then brought to a sharp focus on the ground glass on the back of the camera and when the final adjustment had been made another notch was filed on the back of the fine adjustment. These two notches gave us a measure of the exact amount it was necessary to turn the fine adjustment in order to change from visual focus to the camera focus. The camera was then loaded and placed on the microscope. In order to avoid blurring the image by vibration the exposures were made by setting the camera for time exposure, then turning on the light for the required length of time (a few exposures were made at 1/25 of a second; for these a trigger release on the camera was used).

The pictures were taken at three different magnifications. For photographs where high magnification was desired, the 4 mm. or 100-power objective was used (Fig. 2, J). Under this magnification the exposure time varied from 16 seconds to as high as 64 seconds. With lower magnifications, the exposure time was decreased. With the 16 mm. or 10-power objective the exposures ranged from one to four seconds (Fig. 2, F). With the 40 mm. or 2.6-power objective, we used exposures as short as 1/25 of a second. It should be noted that different diaphragm openings, different kinds of film, and different distances between the light and microscope would require different exposure times. These have to be determined experimentally for each combination of light, film and stop opening.

A small number of pictures, using stained slides of chick embryos, were taken on Kodachrome film. The resulting Kodaslides are excellent for projection if the exposure time is correct. Kodachrome has less "latitude" than black-and-white film. If it is under- or over-exposed the picture is not only too dark or too "washed out," but the colors will not be true.

The prints shown in this article are enlargements from the 35 mm. negatives. They were made with an enlarger which had been rebuilt from an old bellows camera. Contact prints on film or glass can be mounted for lantern-slide projection. In some cases the negatives themselves are suitable for projecting and may be made into lantern slides. This procedure offers a simple method of making slides or prints of microscopic and smaller microscopic objects.

In making pictures by this method a record should be kept of each exposure, including the following items: exposure number with corresponding subject title, objective used, exposure time, lamp wattage and distances from the microscope to the mirror. Only if a careful record is kept for each exposure can errors be corrected for subsequent ones.

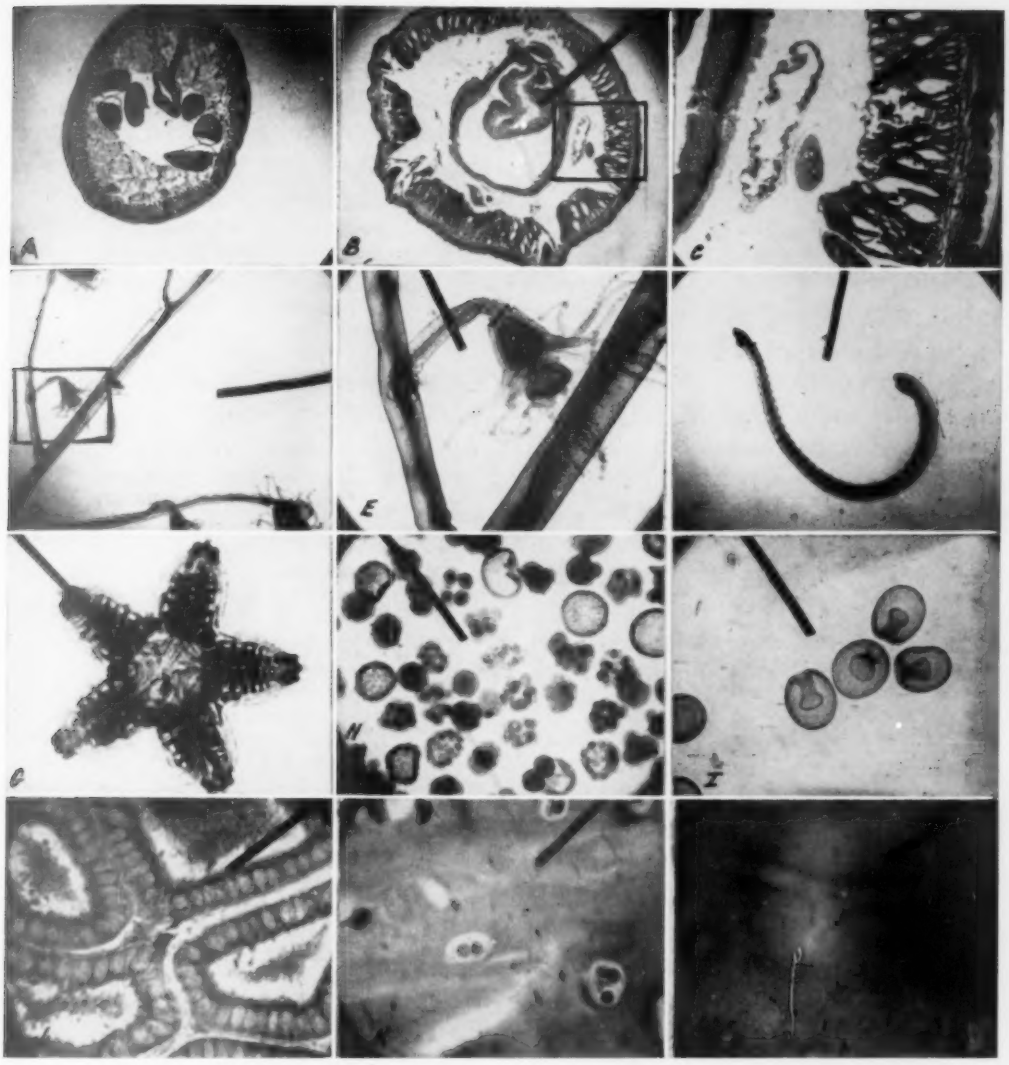


FIG. 2. Series of microphotographs taken with camera as shown in figure 1. Camera set at infinite distance, 10-power ocular on microscope, objective 4, 16, or 40 mm. as indicated below.

A. Cross section of Ascaris, 40 mm. objective.

B. Cross section of earthworm, 40 mm. objective.

C. Marked portion of B, through 16 mm. objective.

D. A portion of a Hydroid colony, 40 mm. objective.

E. Marked portion of D, through 16 mm. objective.

F. Aquatic annelid, 40 mm. objective.

G. Immature starfish, 40 mm. objective.

H. Various stages in cleavage of starfish, 16 mm. objective.

I. Gastrulae of starfish, 16 mm. objective.

J. Section of columnar epithelium, 4 mm. objective.

K. Section of hyaline cartilage, 4 mm. objective.

L. Longitudinal section of bone, 4 mm. objective.

ALLEN DOWNS and LT. THEODORE DOWNS, whose articles appear in this issue, are brothers. Both are interested not only in photography as such, but particularly in its applications to the various teaching fields.

TAKE A PICTURE OF IT

One way to get closer to living things is to photograph them. However, many students and instructors who try this are disappointed simply because they fail to get really close to their subjects. This is almost as true when the subject is a student demonstrating artificial respiration or a victory garden project or a scarlet fever placard on a front door as when it is a bluebird or the leg of a flea.

Several ideas in this issue, notably in the articles on bird photography and photomicrography suggest ways of getting close to the subject. There are others. Even simple box cameras may be fitted with cheap supplementary lenses which shorten the focal length, permitting sharp focus on nearby objects. (Focus before loading camera by holding a piece of ground glass at the open back, having the shutter open as for a time exposure.) An inexpensive holder for cut films may be fitted on a light-proof box behind many kinds of cameras, making it possible to obtain large images of very small objects. Or simpler yet—a piece of black paper with a pine hole in the center may be fastened over the lens, greatly increasing the "depth of focus."

Popular literature is available for both the beginner and expert. This single issue of The American Biology Teacher can merely introduce a few ideas.

My thanks are due the contributors and advisors who assisted with this issue, and particularly to the Editor-in-Chief —to whom has fallen many responsibilities which a guest editor might reasonably be expected to assume.

Lt. (j.g.) Richard F. Trump, U.S.N.R.
Guest Editor

Don't miss any issues of Volume VII. If you have not already done so, be sure to renew your subscription at once.

A PHOTOGRAPHY PROJECT FOR BIOLOGY

Biology Students frequently ask for suggestions on photography as a biology project. The chief difficulty appears to be in finding things to photograph. The following ideas may help you get started.

I. Pictures of trees:
   1. Whole trees, taken against sky background to show typical shapes. Close-ups of bark.
   2. Illustrations of proper planting, bracing, pruning, and other care of young trees.
   3. Decayed places needing treatment or those already treated.
   4. Uses of trees: construction lumber, firewood, erosion control, windbreaks, shade, etc.

II. Pictures of domestic animals:
   1. Different breeds of livestock, poultry: Care and feeding.
   2. Different breeds of dogs and cats; pictures illustrating proper or improper care and training.

III. Pictures illustrating how man controls his environment:
   1. Series contrasting natural woods or prairie with cultivated areas. To show how man has altered natural conditions.
   2. Procedures to control undesirable forms of animal life such as insect pests.
   3. Various agricultural operations.
   4. Flood control, artificial plantings of trees, bird-feeders in use, etc.
   5. Hunting and fishing situations.

IV. Pictures illustrating man's fight against disease:
   1. Quarantine signs on houses.
   2. Hospital facilities for medical treatment.
   3. Illustrations for rules of good diet, cleanliness, etc.
   4. Proper first aid treatments.
   5. Proper and improper means of garbage disposal, etc.

V. Pictures of mammals and birds:
   The easiest way is to place captives in natural surroundings, but such pictures should be labeled to indicate this fact— otherwise the photographer is a "nature faker." (Ask to see the book, *Nature Photography Around the Year.*)

VI. "Table-top" pictures:
   1. Aquarium and terrarium set-ups.

2. "Faked" scenes from nature.
3. Experiments or demonstrations arranged to convey a definite biological idea.

VII. Pictures of animal homes:
1. Bird's nests.
2. Dens in ground, trees, etc.
3. Nests on ground, rabbit, etc.
4. Different kinds of habitats where plants and animals live.

VIII. Pictures of snow scenes and animal tracks. Take them when sun is low so shadows will make tracks more prominent.

GENERAL SUGGESTIONS: Ask for books and articles on how to take *good* pictures. Don't try to take close-ups of small objects such as birds' nests unless your camera can be focused for such pictures. Remember that a picture is often more interesting if it includes a person *who is looking at the object you are photographing.* And above all, remember that your collection of pictures will be worth credit only if it is effectively displayed along with fairly complete notes about *what each picture means.*

B. L. EYESTONE AND RICHARD F. TRUMP
Keokuk Senior High School,
Keokuk, Iowa

DR. GEORGE LYNN CROSS, who has been serving as acting president of the University of Oklahoma since January 1, has been named as permanent head of the institution. Since joining the Oklahoma faculty in 1934 he has served as head of the department of botany, acting dean of the graduate college and acting director of the University of Oklahoma Research institute.

GJERTRUD HJORTH SMITH, president of the Southern California Association of Life Science Teachers, has submitted mimeographed reports of the number of teaching projects which are the result of coordinated efforts of science teachers, counselors and principals. These consist of problems, outlines of teaching units, special courses and programs. Some of the material will appear in early issues of *The American Biology Teacher.*

MODERN METHODS AND MATERIALS for Teaching Science, by Heiss (one of the associate editors of *The American Biology Teacher*), Obourn and Hoffman, published by The Macmillan Company, contains a twenty-one page illustrated chapter on photography, including a list of sources of photographic equipment and a list of selected references.

THE CLEVELAND MEETING

THE REPRESENTATIVE ASSEMBLY met at the Hotel Statler, Cleveland, Ohio, September 15, 1944, for reports of officers and committees and transaction of necessary business. Miss Knauz emphasized that the membership goal still remains 3000. Mr. Russell reported that contributions by members, in response to Dr. Jeffers' invitation, totaled $224.10. The board approved the continuation of *Special Issues* and *Conservation Units.* The price of back numbers of THE AMERICAN BIOLOGY TEACHER was set at 25¢ a copy or $2.00 a volume. An elections committee was appointed, consisting of G. W. Jeffers, Chairman, Prevo. L. Whitaker and H. P. K. Agersborg, Lebanon, Illinois. A number of other items were considered, some of which will be discussed in future numbers of the journal.

The program session was held in the Pine Room of the Statler Hotel on Saturday, September 16, in connection with the fall meeting of THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. President Trowbridge, Glen Ellyn, Illinois, presided over the day session of the program and Past President M. A. Russell, Highland Park, Michigan, was in charge of the banquet.

The outstanding reputation of the speakers on this complete program was influential in bringing out the fine audience which attended all of these meetings. The consensus was that this was one of the finest programs to be presented by THE ASSOCIATION, for it was punctual, pertinent, varied, informative and most interesting. A cooperative, cordial and enthusiastic spirit was in evidence at all times. It was the local committee's careful planning which made this such a pleasant and worthwhile gathering.

The novel feature of this year's program was the Sunday morning visit to the Crile Museum.

The following program was presented:

Word of Welcome
Mr. M. A. Russell, Immediate Past-president, Highland Park Senior High School, Highland Park, Michigan.

New Fronts in Biology Teaching
Mr. Arthur O. Baker, Directing Supervisor in Science, Cleveland Schools, Cleveland, Ohio.

Here, There—Yesterday, Today, Tomorrow
Professor E. Laurence Palmer, Rural Education Department, Cornell University, Ithaca, New York.

The Need Among Teachers for Developing and Maintaining an Adequate Sense of Status

(Cont'd on p. 41)

Why Not A Photo Club?

RALPH A. ROOD
Lakewood High School, Lakewood, Ohio

Nine years of experience as faculty sponsor of a photographic club in a small six-year high school with which I was formerly connected has been so worthwhile and pleasurable that I heartily recommend such a project to other biology teachers. The club with its weekly meetings became an easily motivated activity interesting to all, student and teacher alike. An added advantage was the ease with which money could be raised in connection with the regular work of the group.

For the teacher, it gave a compelling hobby to be shared with a succession of new members to whom the process seemed as magic. To the student member, it brought a start in a life-long recreational activity, as well as an immediate chance to record his biological experiences such as field trips with their views of bird nests, flowers, insects, and the seasonal changes in trees. For the department, it enabled us to develop a collection of visual aids in the form of 8×10 colored enlargements and lantern slides of local material useful in teaching biology.

The plan of organization was kept as simple as possible to allow maximum participation by members. The only requirement was the ownership of some type of camera. Students were admitted from the ninth through the twelfth grades. Semester dues furnished funds for program materials, while the larger sums were raised with the sale of prints of grade- and high-school groups such as homerooms, athletic teams, and plays.

Through the co-operation of the superintendent and the principal, a portion of our store-room was partitioned off, an exhaust fan installed; and a sink and simple table rounded out the essential set-up. Money raised through the years was used in buying a fairly good camera and an enlarger. Other items were constructed by club members in the school shop or were obtained from the local variety stores. The school librarian built a fine reference selection in the subject field, and many of its ideas were tried out by the members.

At the beginning of each semester after the membership was determined, a list of projects was made. Each member was then assigned to a committee, and the vice-president in charge of programs then began to get each group in action at least three weeks before the program date. The actual work was done after school, or at home in the evening, so that a finished result could be shown while demonstrating how to do it.

For example, coloring prints was a part of a series of meetings involving flower photography. The series included program items on lighting, composition, film types, filters, exposure, development, enlargements and finally the coloring. With extra prints, the actual steps in both the oil and the water-color methods were repeated, and the results compared. Finally, those particularly interested were encouraged to try their hand at the process.

For the biology class member, the club was used with projects. For example, one boy had twin sisters. Portraits were taken front and profile to illustrate his report on similarities of physical traits. Another was the use of the camera to illustrate nutrition experiments on rats.

Sphinx moth with cocoons of Braconid parasites.

Small prints were mounted on a chart to illustrate the progressive changes. Still another was that of feet and their care. Normal and flat feet, correct and incorrect type of shoe, the proper and improper way to stand and walk were all illustrated with views of class members. Charts were constructed using enlargements and finally lantern slides were made for use in the department with later classes.

I found no end to program material available—photomicrographs, trick pictures, photographic cartoons, special effects with extension bellows, and many others. Frequent emphasis on fundamentals was given by deliberately doing something wrong to see what would happen.

The time I have devoted to this work has been well worth the effort. Two boys later helped pay college expense through the skills developed in the club, while one exceptional lad went on to professional training and is now with the photographic division of the army air force. The enthusiasm of many other club members has more than repaid me for my efforts. Let me again recommended such a club to other biology teachers.

Larva of Monarch butterfly.

(Cont'd from p. 39)

W. W. Martin, Former Professor of Psychology, The Woman's College of the University of North Carolina, Greensboro, North Carolina.

Aviation Calls the Doctor

Dr. Andrew C. Ivy, The Medical School, Northwestern University, Chicago, Illinois.

Tropical Diseases

Dr. Carroll L. Birch, College of Medicine, University of Illinois, Chicago, Illinois.

The Nation's Health Lies in the Soil

Mr. Ollie E. Fink, Curriculum Supervisor, Conservation Education, State of Ohio, Columbus, Ohio.

BANQUET ADDRESS

"The Science of Biology and the Future of Man"

Dr. Anton J. Carlson, President, *The American Association for the Advancement of Science,* Professor Emeritus of Physiology, University of Chicago, Chicago, Illinois.

SUNDAY—CRILE MUSEUM

Lecture, *"Evolution of Energy Releasing Systems in the Animal Body,"* and Tour of the Museum, Dr. Daniel P. Quiring, Western Reserve University, Cleveland, Ohio.

After Exposure—What?

The Darkroom Versus The Corner Drug Store

JAMES PERKINS SAUNDERS
Northbridge Senior High School, Whitinsville, Massachusetts

"You Press The Button—We'll Do The Rest."—Years ago this slogan was coined by one of the early manufacturers of popular snapshot cameras. Quickly the simple expression caught the public fancy. Around this idea there has been built up a sizable army of snap-shotters who *press the button* and then take the roll of film to the corner drug store to have them *do the rest.* While this procedure may be acceptable to a majority of picture makers, it should not be followed by those who would derive the utmost from their picture-taking efforts.

The biologist, because of his specialized training, is well aware of the unlimited photographic possibilities in the living world. If he takes pictures, he usually has a definite idea of just what he wants. If he is a teaching biologist, he has some plan in mind as to exactly how the pictures will be used in the classroom to illustrate some unit of work. To be able to develop these ideas to the fullest extent, it is important that *control* of all the photographic processes remain in the photographer's hands—in the hands of the one who has the definite ideas in his mind.

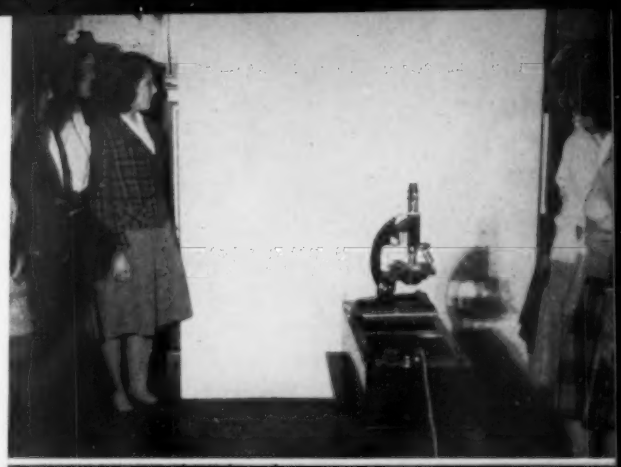
To get the most out of photography, one should do his own photo-finishing. This requires a darkroom and some special equipment, to be sure, but it is surprising how easily the simple requirements may be met.

The darkroom may be anything from most *any* room after dark, with simple window coverings, to a specially constructed room. The main thing is to provide for *complete* darkness so that even the fast panchromatic materials may be processed. If a sink and running water can be provided, so much the better, but work can be done even in a closet where all solutions have to be made up outside and carried in, and where washing has to be done elsewhere. As far as school is concerned, possibly you are fortunate in having a suitable darkroom already provided. Maybe your school has a Camera Club. Arrange to make use of it. The Biology Department and the Camera Club should should be on friendly terms. Possibly you could form a Biological Photographic Club to combine both activities. By all means provide yourself with some form of a darkroom, no matter how simple or humble and use it!

While space limitations prohibit a complete discussion of darkroom procedures, a few suggestions may be helpful. For more detailed information the reader is referred to the list of references at the end of this article.

Of all the methods of developing, the *time and temperature tank method* is much to be preferred. Inexpensive developing tanks made of bakelite are obtainable with adjustable reels to take most of the usual sizes of film from 35 mm. to 616. The film is slipped on the reel in total darkness, the reel placed in the tank, and the cover put on. All remaining steps in the developing process may be carried on in the light.

While film developing may be the least interesting part of photography, it must



TOP PHOTO: (snapshot) Straight enlargement of straightforward photograph using artificial illumination. Since the final desired photo was to show students watching Paramecia as projected on screen by micro-projector, students are arranged so as to be looking at screen.

MIDDLE PHOTO: (time exposure) Straight enlargement of straightforward photograph using only the light which came from the screen and the micro-projector. Since any other light in the room causes the image of the Paramecia to fade out on the screen it was impossible to include enough light to show any students.

BOTTOM PHOTO: Multiple enlargement using the two above negatives combined by dodging to give the final desired result. This photo would *only* be possible by *control* in the *darkroom*—never would it be possible through the *corner drug store*.

be kept in mind that all future work with the film depends upon careful and exact work at this stage.

Chemicals for developing, printing, and enlarging might well be purchased in the prepared powder form which merely requires the addition of water to make a quart, half-gallon, or gallon of the desired solution. Leave to the more technically minded photographer the mixing of complicated chemical formulae.

For *contact* printing, some type of printing box should be built, or purchased. However, if the box is homemade, the builder may incorporate any special or desirable features in its design. Such features as will allow dodging, light control, and adjustable masking will give the operator more control. Very satisfactory designs for homemade printing boxes can often be found in most popular books and magazines on photography.

The photographer will soon find, however, that straight *contact* prints are of limited value. This is especially true of prints from the smaller-sized cameras. As far as classroom use is concerned, the principal use of *contact* prints is found in the field of projection where the print is made on a lantern slide plate, or on safety positive film, bound between glass plates, and projected on a screen.

It is here in the field of the making of projection slides that we first see the value of the darkroom over the corner drug store. You cannot take your film

to a drug store and say; "Please develop this roll for me and give me one *projection slide* of each good exposure." The making of projection slides is too specialized for the "run-of-the-mill" photofinisher. In most cases, if you want these slides you will have to make them yourself. And—in making them yourself, you can *control* all the steps in the finishing process to obtain the exact effect you wish to bring out for your classes.

For those who feel that the making of projection slides is too complicated, let it be said right now that the process is fundamentally the same as that used in making contact prints on paper. If you can make good contact prints on paper, you can, with a little practice, make good projection slides. Try it!

With your smaller sized negatives you will probably use the newer 2×2-inch slides and projector. With your larger negatives you may wish to use the larger $3\frac{1}{4} \times 4$-inch slides and the standard lantern-slide projector. By either enlargement or reduction, however, any sized negative may be made into a slide of either size. The Data Book on Slides and Transparencies gives you all the detailed information.

While we are on the subject of projection slides we should not fail to mention the most ideal type of 2×2 inch slide—the Kodachrome slide. This type of silde is processed by the manufacturer. The use of this full color slide in classroom teaching is increasing, for it brings into class all the shape and design formerly brought by the black and white slide, plus the *color*. To use this type of slide the teacher-photographer must have a camera of the proper size and type to take Kodachrome film. Your dealer can answer your questions or you may consult the Data Book on Kodachrome. You then merely load your camera with this film, expose according to simple directions, and send your film to the manufacturer's film processing laboratory. The pictures will be returned to you in the form of slides ready to be projected in your classroom in a 2×2-inch slide projector.

If prints on *paper* are to be used in the classroom they will, in most cases, have to be *enlargements*. To obtain enlargements will require an enlarging machine. These are obtainable in various sizes and price ranges. Fundamentally, the enlarging process is similar to the contact printing process, except that the negative is placed in the enlarger and a magnified image of the negative is projected onto the paper. Once the exposure of the paper has been made, the development of the image is much the same as with contact prints.

Here in enlarging we find the maximum opportunity for *control* of the desired final effect. By varying the degree of enlargement any desired size of picture may be obtained, or only a small portion of the original negative may be enlarged and used for the final print. By careful selection of the portion of the negative to be enlarged, great improvement in composition of the picture may be made. By dodging, the tonal values of the lights and shades may be altered to produce unusual effects, to emphasize some portions and subdue other portions, or to overcome some defect in the original subject, or in the negative. By multiple printing, several separate negatives may be combined into one print. (See accompanying illustrations.) Here in enlarging we find the greatest argument for the darkroom in preference to the corner drug store.

The uses for enlarged photographs in the classroom are almost unlimited. They may be used on the bulletin board, passed around class, used in an opaque

projector, used to illustrate procedures in experiments, or even for publicity for the Biology Department in school, or in the community.

However, if you wish to obtain the utmost from your pictures, you should give some thought to the mounting of the prints. Prints which are to be passed around class may be mounted on stiff cardboard and protected by a covering of cellophane firmly fastened to prevent removal or tearing. Prints for the opaque projector may be mounted on stiff cardboard of a dark neutral color of suitable size to be handled by the machine. Enlargements to be used on either the classroom or school bulletin boards might well be mounted as are photographic Salon entries—on large mounting boards. Why not combine science and art, when the occasion permits?

For the wide-awake, interested teacher-photographer there can be no doubt as to the answer to the question—"After Exposure — What?" — The *Darkroom* will win over the *Corner Drug Store* every time. So—Biology Teachers—Let's, photographically speaking, adopt another slogan: "We'll press the button and we'll do the rest OURSELVES!"

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Filming in the High Country

ALFRED M. BAILEY

The Colorado Museum of Natural History, Denver, Colorado

The high places have always appealed to me. The dark evergreen forests and open glades, which rise two miles above the sea, are the home of a myriad of secretive feathered folk that present a real challenge to one with an inquisitive nature. We know so little about their habits, for the country is large and the breeding season short. All are so inconspicuous around the nesting areas that usually year after year rolls along without our finding some particular needle in the haystack for which we have long been searching.

Each season sees us afield with our cameras above the timber line far up on the wind-swept mountain tops where we can look upon the forests below, hoping that some unwary ptarmigan will go back to her nest and so reveal the dark blotched eggs tucked away alongside a lichen-covered boulder. We have no difficulty finding the males; oftentimes they advertise their presence by rising in the air on fast moving wings, cackling as they flutter upward and continuing to do so as they drop back to some prominent perch. We have watched them for hours, hoping they would pay a visit to their incubating mates; we have combed the

Boulder-strewn Alpine Flats at 13,000 feet. Courtesy of Colorado Museum of Natural History.

steep hillsides at around 13,000 feet elevation until exhausted, but our efforts have been unsuccessful. However, our exercise has not been in vain, for we have had wonderful days along the alpine flower-covered slopes where the globe flowers grow from along the edges of the snow banks, the marsh marigolds line the crystal clear streams, and the colorful Perry's primroses enliven every sheltered nook.

We have watched the flocks of rosy finches as they fed upon the melting snow banks and have found their nests high above almost inaccessible cliffs, where it was difficult to lash a movie camera; and we secured our pictures by throwing light with a mirror into the dark crevices in which they made their homes.

Then there are the ever present Rocky Mountain pipits, near relatives of the forms nesting in Arctic Alaska and Canada. They are always hovering anxiously near, perching upon the great granite boulders and jerking their tails nervously as they keep track of our progress across the alpine boulder fields. Occasionally a pipit will flutter from under foot, jumping from her eggs which are well hidden in the moss, but it is surprising how much territory one can cover without finding a nest.

Coneys, the little tailless rock rabbits of the rock slides, keep up their incessant shrill piping and the marmots pose motionless as long as we keep our distance, and then when danger threatens, they dive headlong into their rock-lined burrows.

It is in the depths of the dark Engelmann spruce forests below, however, that the naturalist becomes humble. The Audubon warbler and the hermit thrush sing from the depths of the woods, their beautiful songs seeming to come from all directions at once. But rarely do we find a nest.

There are three species of birds in these Canadian Zone woods that we have long desired to photograph; year after year we have searched for the homes of

the pine grosbeak, the Clark's crow, and the Rocky Mountain jay, and season after season our efforts have been unsuccessful.

The jay has been a particular challenge to us. We have made trips into the hills as soon as the drifted snow would allow, taking strenuous journeys on snowshoes along the steep slopes of the spruce-clad mountains; we have watched the gray-colored birds come to our camp fires and take the food we offered and fly silently away; and then we have endeavored to follow them—without success.

One season Mr. Neidrach and I were again in the high country, this time on Mt. Engelmann, near timberline. Snow-covered peaks were silhouetted against the cloud-flecked sky and the mountain streams were rushing, bank full, as the sun worked on the vast melting slopes above. The arctic willows were coming in bud, and the first white-crowned sparrows had arrived in their summer haunts along with their colorful neighbors, the pileolated warblers.

We stopped to eat our lunch, and soon had several jays hovering inquiringly about. As one hopped upon a log within arm's length, we quickly set up our motion camera and then placed bread crumbs a few feet away. He was a greedy fellow and allowed us little time for photography, for scarcely had we backed away from the improvised feeding shelf before he swooped down and started gorging. After his beak and throat were crammed, he launched himself down the mountainside on outspread wing and crossed the little valley, disappearing into the dense spruce tangle near a dead snag which stood sentinel-like on the opposite slope. It seemed evident that our jay was carrying food to young or to be cached away for future use. With our equipment on our backs, we hurried to the dead tree and then separated to search for the proverbial needle.

In the perpetual gloom of the heavy forests it is almost a hopeless task to *look* for nests; keen ears are more essential than eyes, but if one is endowed with both, as is Neidrach, he is twice blessed. It was not long before a loud yell from down the slope brought the cheering news that the home of our intended photographic victim had been found. The nest was rather a small affair for such a large bird, just a bundle of sticks in an Engelmann spruce, about 25 feet from the ground. Both parents were on the scene, one flying anxiously about with querulous cries and the other calmly feeding the begging young, paying no attention to us.

Three small spruces were quickly cut and formed into a tripod to hold our camera on the level with the nest, and cross pieces were lashed into place for the photographers to stand upon. It was not necessary to use a blind, as is usually the case in bird work, for the jays soon became accustomed to our presence and would alight near the camera, grabbing with scant ceremony the bits of our lunch held out to them. Then they would quickly wheel to the nest, chuck the food down the throats of the eager young and return for another handout. It was as

Colorado jay on its nest. Colorado Museum of Natural History.

near active cooperation from parent birds as a nature photographer ever receives.

And so our efforts to film the home life of the Rocky Mountain jay proved an anti-climax. We had searched hard and long to find them, and then our prey had proved disappointingly tame. We had secured the film desired, it is true, but we had no longer an excuse to go into the high places searching for the haunts of an elusive bird—our quest for the home of the camp robber was over. We had learned once again that anticipation brings pleasure and that success often is tinged with regret.

ATTENTION LOCALS: Have your secretary send me a request for special *announcement-report forms*. Your news will be published if you send it to me at once; include ideas and contributions of your individual members.

PREVO L. WHITAKER,
University High School,
Bloomington, Indiana

If you have not already renewed your membership be sure to do so at once. We cannot continue to send the journal to anyone whose name is not on our paid up list. The *November* issue will be the last one you will receive unless you have renewed your membership by *November 25*.

M. A. RUSSELL
Secretary-Treasurer

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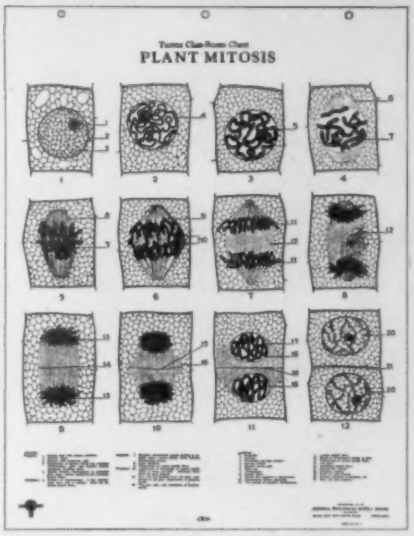

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